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Indian Standard

SPECIFICATION FOR DATA INTERCHANGE ON 130 mm, DOUBLE SIDED, 3·8 tpmm, FLEXIBLE DISK CARTRIDGES USING MODIFIED FREQUENCY MODULATION RECORDING

PART 2 TRACK FORMAT A

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR DATA INTERCHANGE ON 130 mm, DOUBLE SIDED, 3·8 tpmm, FLEXIBLE DISK CARTRIDGES USING MODIFIED FREQUENCY MODULATION RECORDING

PART 2 TRACK FORMAT A

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SPECIFICATION FOR DATA INTERCHANGE ON 130 mm, DOUBLE SIDED, 3·8 tpmm; FLEXIBLE DISK CARTRIDGES USING MODIFIED FREQUENCY MODULATION RECORDING

PART 2 TRACK FORMAT A

0. FOREWORD

0.1 This Indian Standard (Part 2) was adopted by the Indian Standards Institution on 10 June 1986, after the draft finalized by the Computers, Business Machines and Calculators Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard specifies the characteristics of 130 mm flexible disk cartridges recorded at 7 958 ftprad, 3·8 tpmm, on both sides using modified frequency modulation (MFM) recording. Part 1 of the standard specifies the dimensional, physical and magnetic characteristics of the cartridge so as to provide physical interchangeability between data processing systems.

Together with the labelling scheme specified in IS : 11406-1986*/ ISO 7665-1983 this standard (Parts 1 and 2) provide for full data interchange between data processing systems.

0.3 The Part 3 of this standard specifies an alternative track format for data interchange.

0.4 This standard is based on ISO/DIS 8378/2 'Information processing — Data interchange on 130 mm (5·25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 3·8 tpmm (96 tpi), on two sides — Part 2 : Track formet A', issued by the International Organization for Standardization (ISO).

*File structure and labelling of flexible disk cartridges for information interchange.

1. SCOPE

1.1 This standard (Part 2) specifies the quality of recorded signals, the track layout, and a track format to be used on such a flexible disk cartridge, which is intended for data interchange between data processing systems.

2. TERMINOLOGY

2.1 For the purpose of this standard, the terms and definitions as given in IS : 1885 (Part 52)* series shall apply.

3. GENERAL REQUIREMENTS

3.1 Mode of Recording

3.1.1 *Track 00, Side 0* — The mode of recording shall be two-frequency where the start of every bit cell is a clock flux transition. A ONE is represented by a data flux transition between two clock flux transitions. Exceptions to this are defined in **3.12**.

3.1.2 *All Tracks Other Than Track 00, Side 0* — The mode of recording shall be Modified Frequency Modulation (MFM) for which the conditions are:

a) a flux transition shall be written at the centre of each bit cell containing a ONE;

b) a flux transition shall be written at each cell boundary between consecutive bit cells containing ZERO's.

Exceptions to this are defined in **3.12**.

3.2 Track Location Tolerance of the Recorded Flexible Disk Cartridge — The centre lines of the recorded track shall be within $\pm$ 0·085 mm of the nominal positions, over the range of operating environment specified in Part 2 of this standard. This tolerance corresponds to twice the standard deviation.

3.3 Recording Offset Angle — At the instant of writing or reading magnetic transition, the transition may have an angle between $-18'$ and $+51'$ with the radius (*see* Fig. 1). This tolerance corresponds to twice the standard deviation.

NOTE — As tracks may be written and overwritten at extremes of the tolerances given in **3.2** and **3.3** a band of old information may be left at one edge of the newly written data and would constitute unwanted noise when reading. It is, therefore, necessary to trim the edges of the tracks by erasure after writing.

*Electrotechnical vocabulary: Part 52 Data processing.

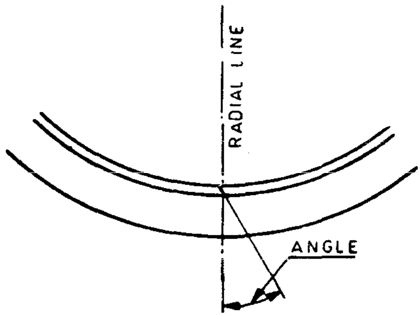

FIG. 1 RECORDING OFFEST ANGLE

3.4 Density of Recording

3.4.1 The nominal density of recording shall be 7 958 ftprad. The nominal bit cell length for track 00, side 0 is 251 μrad, and for all the other tracks it is 125·5 μrad.

3.4.2 The long-term average bit cell length shall be the average bit cell length measured over a sector. It shall be within $\pm$3·5 percent of the nominal bit cell length.

3.4.3 The short-term average bit cell length, referred to a particular bit cell, shall be the average of the lengths of the preceding eight bit cells. It shall be within $\pm$8 percent of the long-term average bit cell length.

3.5 Flux Transition Spacing — The instantaneous spacing between flux transitions may be influenced by the reading and writing process, the bit sequence recorded (pulse crowding effects), and other factors. The locations of the transitions are defined as the locations of the peaks in the signal when reading. Tests should be carried out using a peak-sensing amplifier.

3.5.1 *Flux Transition Spacing for Track 00, Side 0* (*see* Fig. 2).

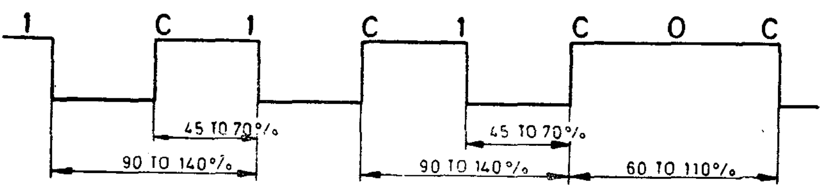

FIG. 2 FLUX TRANSITION SPACING ON TRACK 00, SIDE 0

3.5.1.1 The spacing between two clock flux transitions surrounding a data flux transition or between two data flux transitions surrounding a clock flux transition shall be between 90 and 140 percent of the nominal bit cell length.

3.5.1.2 The spacing between two clock flux transitions not surrounding a data flux transition or between two data flux transitions surrounding a missing clock flux transition shall be between 60 and 110 percent of the nominal bit cell length.

3.5.1.3 The spacing between a data flux transition and the preceding clock flux transition (when not missing) or between a clock flux transition and the preceding data flux transition (when not missing) shall be between 45 and 70 percent of the nominal bit cell length.

3.5.2 *Flux Transition Spacing for all Tracks Other than Track 00, Side 0* (*see* Fig. 3).

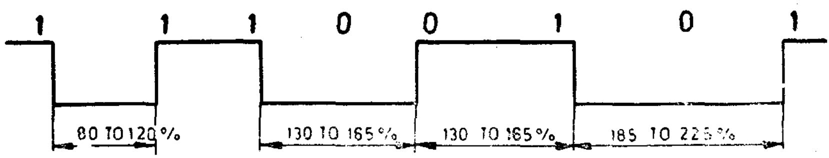

FIG. 3 FLUX TRANSITION SPACING ON ALL TRACKS

3.5.2.1 The spacing between the flux transitions in a sequence of ONE's shall be between 80 and 120 percent of the short-term average bit cell length.

3.5.2.2 The spacing between the flux transition for a ONE and that between two ZERO's preceding or following it shall be between 130 and 165 percent of the short-term average bit cell length.

3.5.2.3 The spacing between the two ONE flux transitions surrounding a ZERO bit cell shall lie between 185 and 225 percent of the short-term average bit cell length.

3.6 Average Signal Amplitude — For each side the average signal amplitude on any non-defective track (*see* Part 1 of this standard) of the interchanged flexible disk cartridge shall be less than 160 percent of SRA_{1f} and more than 40 percent of SRA_{2f}.

3.7 Byte — A byte is a group of eight bit-positions, identified as B1 to B8, with B8 the most significant and recorded first.

The bit in each position is a ZERO or a ONE.

3.8 Sector — All tracks are divided into 16 sectors.

3.9 Cylinder — A pair of tracks, one on each side, having the same track number.

3.10 Cylinder Number — The cylinder number shall be a two-digit number identical with the track number of the tracks of the cylinder.

3.11 Data Capacity of a Track — The data capacity of track 00, side 0 shall be 2 048 bytes. The data capacity of all tracks other than track 00, side 0 shall be 4 096 bytes.

3.12 Hexadecimal Notation — Hexadecimal notation shall be used hereafter to denote the following bytes:

(00) for (B8 to B1) = 00000000

(01) for (B8 to B1) = 00000001

(FF) for (B8 to B1) = 11111111

(FE)* for (B8 to B1) = 11111110

where the clock transitions of B6, B5 and B4 are missing.

(FB)* for (B8 to B1) = 11111011

where the clock transitions of B6, B5 and B4 are missing.

(F8)* for (B8 to B1) = 11111000

where the clock transitions of B6, B5 and B4 are missing.

(4E) for (B8 to B1) = 01001110

(FE) for (B8 to B1) = 11111110

(FB) for (B8 to B1) = 11111011

(F8) for (B8 to B1) = 11111000

(A1)* for (B8 to B1) = 10100001

where the boundary transition between B3 and B4 is missing.

3.13 Error Detection Characters (EDC) — The two EDC-bytes are hardware generated by shifting serially the relevant bits, specified later for each part of the track through a 16-bit shift register described by:

$$X^{16} + X^{12} + X^{5} + 1$$

(*see also* Appendix A).

4. TRACK LAYOUT AFTER THE FIRST FORMATTING FOR TRACK 00, SIDE 0

4.0 After first formatting, there shall be 16 usable sectors on the track. The layout of the track shall be as shown in Fig. 4.

During formatting the rotational speed of the disk, averaged index to index, shall be 300 $\pm$ 6 rev/min.

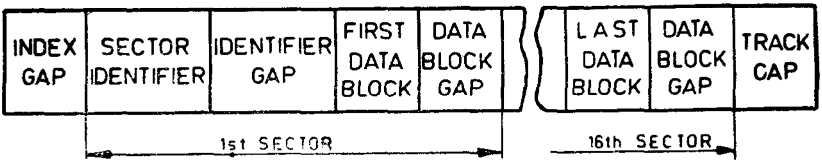

FIG. 4 TRACK LAYOUT

4.1 Index Gap — At nominal density, this field shall comprise 16 (FF)-bytes. Writing the index gap is started when the index hole is detected. Any of the first 8 bytes may be ill-defined due to subsequent overwriting.

4.2 Sector Identifier — This field shall be as given in Table 1.

TABLE 1 SECTOR IDENTIFIER

Identifier Mark		Address Identifier				
		Track Address		S		EDC
6 bytes (00)	1 byte (FE)	C 1 byte (00)	Side 1 byte	1 byte	1 byte (00)	2 bytes

4.2.1 *Identifier Mark* — This field shall comprise 7 bytes:

6(00)-bytes

1(FE)*-byte

4.2.2 *Address Identifier* — This field shall comprise 6 bytes.

4.2.2.1 *Track address* — This zone shall comprise two bytes:

a) Cylinder address (C) — This field shall specify in binary notation the cylinder address. It shall be (00) for all sectors.

b) Side number (side) — This field shall specify the side of the disk. It shall be (00) for all sectors.

4.2.2.2 *Sector number(s)* — The 3rd byte shall specify in binary notation the sector number from 01 for the 1st sector to 16 for the last sector.

The 16 sectors shall be recorded in the natural order:

1, 2, 3, ... 15, 16

4.2.2.3 *4th byte of the sector address* — The 4th byte shall always be a (00)-byte.

4.2.2.4 *EDC* — These two bytes shall be generated as defined in **3.13** using the bytes of the sector identifier starting with the (FE)*-byte (*see* **4.2.1**) of the identifier mark and ending with the 4th byte (*see* **4.2.2.3**) of the sector address.

4.3 Identifier Gap — This field shall comprise 11 initially recorded (FF)-bytes.

4.4 Data Block — This field shall be as given in Table 2.

TABLE 2 DATA BLOCK

Data Mark		Data Field	EDC
6 bytes	1 byte	128 bytes	2 bytes
(00)	(FB)*		

4.4.1 *Data Mark* — This field shall comprise:

6(00)-bytes

1(FB)*-byte

4.4.2 *Data Field* — This field shall comprise 128 bytes. No requirements are implied beyond the correct EDC for the content of this field [*see also* **6.4.2.4**(b)].

4.4.3 *EDC* — These two bytes shall be generated as defined in **3.13** using the bytes of the data block starting with the 7th byte of the data mark (*see* **4.4.1**) and ending with the last byte of the data field (*see* **4.4.2**).

4.5 Data Block Gap — This field shall comprise 27 initially recorded (FF)-bytes. It is recorded after each data block and it precedes the following sector identifier. After the last data block, it precedes the track gap.

4.6 Track Gap — This field shall follow the data block gap on the 16th sector. (FF)-bytes are written until the index hole is detected, unless it has been detected during writing of the last data block gap, in which case there shall be no track gap.

5. TRACK LAYOUT AFTER THE FIRST FORMATTING FOR ALL TRACKS OTHER THAN TRACK 00, SIDE 0

5.0 After the first formatting, there shall be 16 usable sectors on each track. The layout of each track shall be as shown in Fig. 5.

During formatting the rotational speed of the disk, averaged index to index, shall be 300 ± 6 rev/min.

Bits of the 7-bit combination	0	b7	b6	b5	b4	b3	b2	b1
Bit-positions in the byte	B8	B7	B6	B5	B4	B3	B2	B1

FIG. 5 BIT POSITION IN 7-BIT CODE

5.1 Index Gap — At nominal density, this field shall comprise 32 (4E), bytes. Writing the index gap is started when the index hole is detected. Any of the first 16 bytes may be ill-defined due to subsequent overwriting.

5.2 Sector Identifier — This field shall be as given in Table 3.

TABLE 3 SECTOR IDENTIFIER

Identifier Mark			Address Identifier				
			Track Address		S		EDC
12 bytes (00)	3 bytes (A1)*	1 byte (FE)	C 1 byte	Side 1 byte (00) or (01)	1 byte	1 byte (01)	2 bytes

5.2.1 *Identifier Mark* — This field shall comprise 16 bytes:

12(00)-bytes

3(A1)*-bytes

1(FE)-byte

5.2.2 *Address Identifier* — This field shall comprise 6 bytes.

5.2.2.1 *Track address* — This field shall comprise 2 bytes:

a) *Cylinder address (C)* — This field shall specify in binary notation the cylinder address from 00 for the outermost cylinder to 77 for the innermost cylinder.

b) *Side number (side)* — This field shall specify the side of the disk. On side 0, it shall be (00) on all tracks. On side 1, it shall be (01) on all tracks.

5.2.2.2 *Sector number(s)* — The 3rd byte shall specify in binary notation the sector number from 01 for the 1st sector to 16 for the last sector.

The sectors shall be recorded in the natural order:

1, 2, 3...15, 16

5.2.2.3 *4th byte* — The fourth byte shall always be a (01)-byte.

5.2.2.4 *EDC* — These two bytes shall be generated as defined in **3.13** using the bytes of the sector identifier starting with the first (A1)*-byte (*see* **5.2.1**) of the identifier mark and ending with the 4th byte (*see* **5.2.2.3**) of the sector address.

5.3 Identifier Gap — This field shall comprise 22 initially recorded 4(E)-bytes.

5.4 Data Block — This field shall be as given in Table 4.

TABLE 4 DATA BLOCK

DATA MARK			DATA FIELD	EDC
12 bytes (00)	3 bytes (A1)*	1 byte (FB)	256 bytes	2 bytes

5.4.1 *Data Mark* — This field shall comprise:

12 (00)-bytes

3 (A1)*-bytes

1 (FB)-byte

5.4.2 *Data Field* — This field shall comprise 256 bytes. No requirements are implied beyond the correct EDC for the content of this field [*see also* **6.4.2.4**(b)].

5.4.3 *EDC* — These two bytes shall be generated as defined in **3.13** using the bytes of the data block starting with the first (A1)*-byte of the data mark (*see* **5.4.1**) and ending with the last byte of the data field (*see* **5.4.2**).

5.5 Data Block Gap — This field shall comprise 54 initially recorded (4E)-bytes. It is recorded after each data block and it precedes the following sector identifier. After the last data block, it precedes the track gap.

5.6 Track Gap — This field shall follow the data block gap of the last sector. (4E)-bytes are written until the index hole is detected, unless it has been detected during writing of the last data block gap, in which case there shall be no track gap.

6. TRACK LAYOUT OF A RECORDED FLEXIBLE DISK FOR DATA INTERCHANGE

6.1 Representation of Characters — Characters shall be represented by means of the 7-bit coded character set (*see* IS : 10315-1982*) and, where required, by its 7-bit or 8-bit extensions or by means of the 8-bit coded character set (*see* IS : 10401-1982†).

*Specification for 7-bit coded character set for information interchange.

†Specification for 8-bit coded character set for information interchange.

Each 7-bit coded character shall be recorded in bit-positions B7 to B1 of a byte; bit position B8 shall be recorded with bit ZERO.

The relationship shall be as shown in Fig. 5.

Each 8-bit coded character shall be recorded in bit-positions B8 to B1 of a byte.

The relationship shall be as shown in Fig. 6.

Bits of the 8-bit combination	b8	b7	b6	b5	b4	b3	b2	b1
Bit-positions in the byte	B8	B7	B6	B5	B4	B3	B2	B1

FIG. 6 BIT POSITION IN 8-BIT CODE

6.2 Good and Bad Cylinders — A good cylinder is a cylinder which has both tracks formatted according to **6.4**.

A bad cylinder is a cylinder which has both tracks formatted according to **6.5**.

6.3 Requirements for Cylinders — Cylinder 00 shall be a good cylinder and shall have no defective sectors on side 0. There shall be at least 77 good cylinders between cylinder 01 and cylinder 79.

6.4 Layout of the Tracks of a Good Cylinder — References to **4** are for track 00, side 0. References to **5** are for all other tracks.

6.4.1 *Index Gap* — For description *see* **4.1** and **5.1**.

6.4.2 *Sector Identifier*

6.4.2.1 *Identifier mark* — For description, *see* **4.2.1** and **5.2.1**.

6.4.2.2 *Address identifier* — For description, *see* **4.2.2** and **5.2.2**.

a) *Track address* — This field shall comprise 2 bytes:

1) *Cylinder address* (*C*) — This field shall specify in binary notation the cylinder address from 00 for the outermost cylinder to 77 for the innermost cylinder.

NOTE — A unique cylinder number is associated with each cylinder (*see* **3.10**). Two of these cylinders are intended for use only when there are one or two defective cylinders. Each good cylinder possess a unique cylinder address; a defective cylinder does not possess a cylinder address. Cylinder addresses are assigned consecutively to the good cylinders in the ascending sequence of cylinder addresses.

2) *Side number* (*side*) — For description, *see* **4.2.2.1** and **5.2.2.1**.

b) *Sector number* (*S*) — For description, *see* **4.2.2.2** and **5.2.2.2**.

c) *Fourth byte* — For description, *see* **4.2.2.3** and **5.2.2.3.**

d) *EDC* — For description, *see* **4.2.2.4** and **5.2.2.4.**

6.4.2.3 *Identifier gap* — For description, *see* **4.3** and **5.3.** These bytes may have become ill-defined due to the overwriting process.

6.4.2.4 *Data block*

a) *Data mark* — For track 00, side 0, this field shall comprise

6 (00)-bytes

1 byte

The 7th byte shall be (FB)* indicating that the data are valid and that the whole data field can be read; and (FB)* indicating that the first byte of the data field shall be interpreted according to ISO 7665.

For all other tracks, this field shall comprise

12 (00)-bytes

3 (A1)*-bytes

1 byte

The 16th byte shall be (FB) indicating that data are valid and that the whole data field can be read.

b) *Data field* — This field shall comprise 128 bytes or 256 bytes as specified in **4.4.2** and **5.4.2.**

If it comprises less than the requisite number of data bytes, the remaining positions shall be filled with (00)-bytes.

Data fields in cylinder 00 are reserved for operating system use, including labelling.

c) *EDC* — For description, *see* **4.4.3** and **5.4.3.**

If the last byte of the data mark is (F8)* or (F8) and the first character of the data field is capital letter F, the EDC may or may not be correct, as the sector contains a defective area. If the first character is capital letter D, then the EDC shall be correct.

On cylinder 00, only capital letter D shall be allowed.

6.4.2.5 *Data block gap* — This field is recorded after each data block and it precedes the following sector identifier. After the last data block it precedes the track gap.

It comprises initially 27 (FF)-bytes (*see* **4.5**) or 54 (4E)-bytes (*see* **5.5**). These bytes may have become ill-defined due to the overwriting process.

6.4.2.6 *Track gap* — For description, *see* **4.6** and **5.6**.

6.5 Layout of the Tracks of a Bad Cylinder

6.5.1 *Contents of the Fields* — The fields of the tracks of a bad cylinder should have the following contents.

6.5.1.1 *Index gap* — For description; *see* **4.1** and **5.1**.

6.5.1.2 *Sector identifier* — This field should comprise an identifier mark and an address identifier.

a) *Identifier mark* — This field should comprise 16 bytes:

12 (00)-bytes
3 (A1)*-bytes
1 (FE)-byte

b) *Address identifier* — This field should comprise 6 bytes:

4 (FF)-bytes
2 EDC-bytes

These two EDC-bytes shall be generated as defined in **3.13** using the bytes of the sector identifier starting with the first (A1)*-byte [**6.5.1.2**(a)] of the identifier mark and ending with the above 4 (FF)-bytes.

6.5.1.3 *Identifier gap* — This field should comprise 22 (4E)-bytes.

6.5.1.4 *Data block*

a) *Data mark* — This field should comprise 16 (4E)-bytes.
b) *Data field* — This field should contain 256 (4E)-bytes.
c) *EDC* — This field should comprise 2 (4E)-bytes.

6.5.1.5 *Data block gap* — This field should comprise 54 (4E)-bytes.

6.5.1.6 *Track gap* — For description, *see* **5.6**.

6.5.2 *Requirements for Tracks* — Each track of a bad cylinder shall have at least one of its sector identifiers with the content specified in **6.5.1.2**. If this condition is not satisfied, the cartridge shall be rejected. All other fields of such tracks may be ill-defined.

7. ADDITIONAL INFORMATION

7.1 The procedure and equipment for measuring flux transition spacing is given in Appendix B.

7.2 Information on data separator for decoding MFM recording is also given in Appendix C.

APPENDIX A

(*Clause* 3.13)

EDC IMPLEMENTATION

A-1. Figure 7 shows the feedback connections of a shift register which may be used to generate the EDC bytes.

A-2. Prior to the operation, all positions of the shift register are set to ONE. Input data are added (exclusive OR) to the contents of position C_{15} of the register to form a feedback. This feedback is in its turn added (exclusive OR) to the contents of position C_4 and position C_{11}.

A-3. On shifting, the outputs of the exclusive OR gates are entered respectively into positions C_0, C_5 and C_{12}. After the last data bit has been added, the register is shifted once more as specified above.

The register then contains the EDC bytes.

If further shifting is to take place during the writing of the EDC bytes, the control signal inhibits exclusive OR operations.

A-4. To check for errors when reading, the data bits are added into the shift register in exactly the same manner as they were during writing. After the data, the EDC bytes are also entered into the shift register as if they were data. After the final shift, the register contents will be all ZERO if the record does not contain errors.

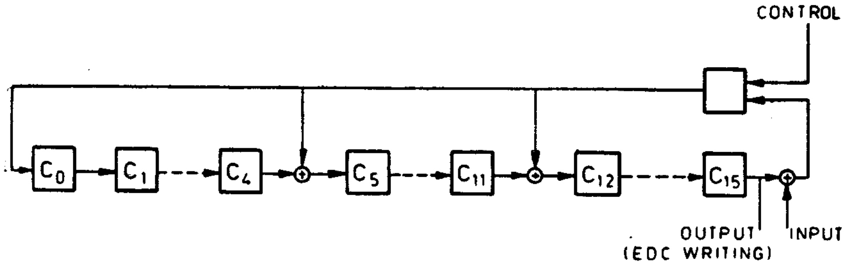

FIG. 7 GENERATION OT EDC

APPENDIX B

(*Clause* 7.1)

PROCEDURE AND EQUIPMENT FOR MEASURING FLUX TRANSITION SPACING

B-1. General — This appendix specifies equipment and a procedure for measuring flux transition spacing on 130 mm (5·25 in) flexible disk cartridges using MFM recording at 7 958 ftprad on two sides.

B-2. Format — The disk to be measured shall be written by the disk drive for data interchange use. Testing shall be done on tracks 00 and 79 on both sides.

Track 00, side 0 shall have the test patterns 00100000 (20) and 11101111 (EF) written repeatedly.

Track 79, side 0, and tracks 00 and 79, side 1, shall have the test patterns 11011011 (DB) and 11011100 (DC) written repeatedly.

B-3. Test Equipment

B-3.1 Disk Drive — The disk shall have a rotational speed of 300 rev/min, with a tolerance of ± 3 rev/min, averaged over one revolution.

The average angular speed taken over 64 μs shall not deviate by more than 0·5 percent from the speed averaged over one revolution.

B-3.2 Head

B-3.2.1 *Resolution* — The head shall have an absolute resolution of 55 to 65 percent at track 79 on each side, using the reference material RM 7 487, applying the calibration factor of the reference material appropriate to the side, and recording with the appropriate test recording current.

The resonant frequency of the head shall be at least 250 000 Hz.

The resolution shall not be adjusted by varying the load impedance of the head.

The resolution shall be measured at the output of the amplifier defined in **B-3.3.1**.

B-3.2.2 *Offset Angle* — The head shall have a gap offset angle of 0° ± 6′ with the disk radius on the testing drive.

B-3.2.3 *Contact* — Care shall be taken that the heads are in good contact with the media during the tests.

B-3.3 Read Channel

B-3.3.1 *Read Amplifier* — The read amplifier shall have a flat response from 1 000 to 187 500 Hz within ± 1 db, and amplitude saturation shall not occur.

B-3.3.2 *Peak Sensing Amplifier* — Peak sensing shall be carried out by a differentiating and limiting amplifier.

B-3.4 Time Interval Measuring Equipment — The time interval counter shall be able to measure 4 μs to at least 10 μs resolution.

A triggering oscilloscope may be used for this purpose.

B-4. Procedure for Measurement

B-4.1 Flux Transition Spacing Measurement — The transition locations shall be measured by the locations of the peaks in the signal when reading.

The flux transition spacing shall be measured by the pulse timing intervals after the read channel amplifier defined in **B-3.3.**

B-4.2 Flux Transition Spacing for Track 00, Side 0 — Measure time intervals t_1 to t_8 as shown in Fig. 8.

t_1 and t_2 correspond to **3.5.1.1.**

t_3 and t_4 correspond to **3.5.1.2.**

t_5, t_6, t_7 and t_8 correspond to **3.5.1.3.**

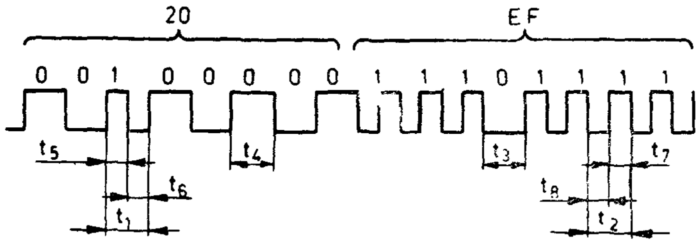

FIG. 8 FLUX TRANSITION ON TRACK 00, SIDE 0

B-4.3 Flux Transition Spacing for all Other Tracks — Measure time intervals t_1 to t_5 as shown in Fig. 9.

t_1 and t_2 correspond to **3.5.2.1.**

t_3 and t_4 correspond to **3.5.2.2.**

t_5 correspond to **3.5.2.3.**

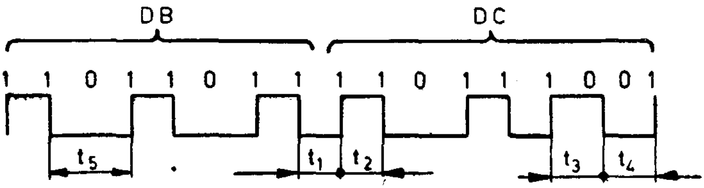

FIG. 9 FLUX TRANSITION OF OTHER TRACES

APPENDIX C

(*Clause* 7.2)

DATA SEPARATORS FOR DECODING MFM RECORDING

C-1. *On track 00, side 0 the two-frequency recording results in nominal* flux transition periods of :

t for a ONE cell

$2t$ for a ZERO cell

where $t = 4\ \mu s$.

The data separator should be capable of resolving a difference of $4\ \mu s$. This can be achieved satisfactorily by the use of a digital data separator, or one using a fixed timer.

C-2. On all other tracks, the MFM recording methods give nominal flux transition spacings of :

t for the patterns 1 1 or 0 0 0

$3t/2$ for the patterns 1 0 or 0 1

$2t$ for the pattern 1 0 1

The data separator should be capable of resolving a difference of only $2/\mu s$. To achieve this with a low error rate, the separator cannot operate on a fixed period but should follow changes in the bit cell length.

It is recognized that various techniques may be developed to achieve dynamic data separation; with present technology only an analogue data separator based on a phase-locked oscillator can provide the necessary reliability.